TOTAL STANDBY POWER CONSUMPTION IN COLLEGE OF SCIENCE AND TECHNOLOGY CAMPUS IN THE ACADEMIC YEAR (AUGUST, 2012 TO APRIL 2013).

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ABSTRACT

This research work contains the study of total standby power consumption in College of Science and Technology campus. Research was carried out in three phases; survey, measurement of standby power consumption and mathematical calculation on energy losses due to standby power consumption.

Measurements were carried out for the various appliance consuming standby power in the campus. Measurement results showed poor power factors at standby mode. Over the survey, laptop was found to be the major appliance in common and maximum in number in the campus. Different brands of laptops and other appliances consuming standby power were measured.

This particular research, first of its kind in Bhutan, attempts to explore the amount of standby power consumed and tries to create public awareness on its impact individually and globally.

Keywords: Standby Power, Energy wastage, Energy crisis, Global concern.

1. INTRODUCTION

The already scarcity in energy – resources are further made scarce by our own negligence and ignorance. Many power consumers do generally have the consumption pattern of keeping the appliances unplugged when not in use primarily, thinking that they are either completely switched off or consumes no power at all. Even if it consumes, they think it is not a big issue for them to pay a small energy bill.

There are certain appliances which consumes standby power when they are not switched off from the mains. Laptops, desktops, TVs, etc., for instance, in standby mode contributes to standby power consumption. The power consumed in standby mode is referred to as the standby power consumption.

Standby power consumed is not only wastage but also a contributor to the monthly energy bill. The amount of standby power consumed individually is small but it sums up to be a huge loss of energy globally especially at this stage of energy crisis. It is a global concern now.

The standby power consumption basically means the power consumed by the appliances when they are not performing their primary functions (Benoit Lebot, 2000). This standby power is consumed by the circuit and sensors inside needed to receive the remote signal, soft keypads and displays including LED status light. The standby power is also consumed by the circuit which continues to energize even when the device is off with mains still in ON state.

2. OBJECTIVES

The main objectives of our project are:

i. To calculate and determine the total Standby Power consumed in College of Science and Technology campus from August, 2012 to April, 2013.

ii. To create public awareness campaign on effects of Standby Power Consumption

iii. To perform analysis on standby power consumed by different graded electrical appliances and then recommend general public to go for the appliances that consumes minimum standby power.

3. METHODOLOGY

3.1 QUESTIONNAIRE

The main objective of framing these questionnaires are as follows:

1. To get the information about the total number of hours the consumers keep their equipment's in standby.
2. To know the general behaviour of the respondents about standby power.
3. To get the details of the equipment having the feature of standby mode.
4. Awareness on the concept of Energy Star Grading on equipment.

The questionnaire was framed based upon three zones:

i. Residential areas,
ii. Office areas, and
iii. Hostel areas.

In general the questionnaire contains definition on standby power consumption, the awareness on standby power consumption and energy star grading. The questionnaire also contains the name of probable equipment; with brand, and quantity of equipment to be filled by the respondents. Further, respondents are asked to fill the average standby time (in hours) per day that they keep their equipment in standby.

During the distribution of questionnaire, firstly the respondents were explained about the objective of the project. They were made aware of the topics: standby and energy star grading. To ensure positive response, respondents were explained about the importance on the future scope of this project.

3.2 METHODOLOGY FOR MEASUREMENT

When the appliance is in standby mode, the power consumption is very low.

Power = Voltage x Current x Power factor

(power consumed is very less so the current in standby mode is also very less)

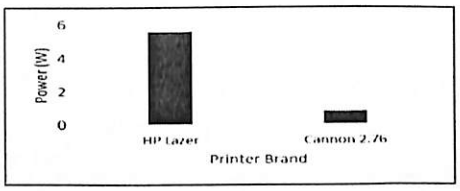
Since the voltage is constant, that is around 230V and assuming power factor to be 0.8 and power consumed to be 30W.

$$\Rightarrow \text{Current} = \frac{230}{0.8 X 30}$$

$$= \underline{0.163}\ A$$

As seen, the value of current is very small at standby mode, so a very precise and small current measuring device is needed for the measurement.

This small power consumed can be measured by using **Kill-a-watt meter**, it is a measuring instrument especially developed for measuring very small power and current. It has high-integration micro-computer chips and special energy metering IC, with high-accuracy current sensor and LCD. This product can monitor electrical equipment including standby power. Power Guard is paced in the equipment for the measurement of low current ensuring high measuring precision. When the power is less than 20W, the power measurement error is in $\pm 0.01 \sim 0.1$W, and the power factor measurement error is in $\pm 0.001 \sim 0.1$ (Electronics, 2012).



4. DATA ANALYSIS

4.1 LAPTOPS

Table 1: Laptops in standby mode

	Brand	Standby power (W)
Standby	HCL	4.1
	Toshiba	1.91
	Compaq	1.14
	HP	1.05
	Asus	0.98
	Dell	0.95
	Lenovo	0.81
	Sony Vaio	0.7
	Acer	0.58
	Samsung	0.55

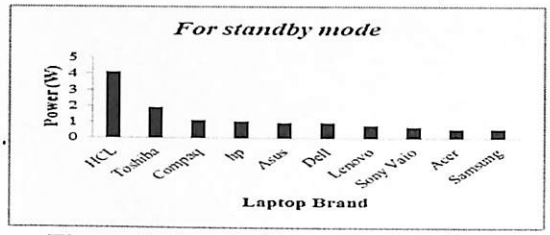


Figure 1: Comparison of laptops in standby mode

The brands of laptops presently used by residents of CST are as shown above. Amongst the list, HCL laptops consumes maximum power while Samsung laptops the least.

4.2 PRINTERS

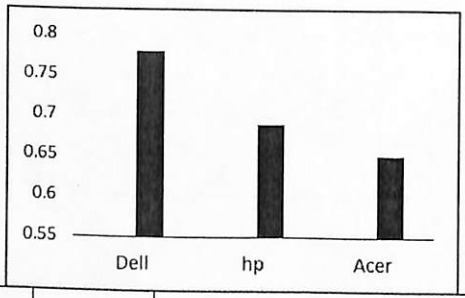
Table 2: Printers in standby mode

	Brand	Standby Power (W)
Standby mode	HP LaserJet	5.61
	Cannon 2.76	0.78

Figure 2: Comparison of printers in standby mode

4.3 DESKTOP

Table 3: Desktops in standby mode



	Brand	Standby Power (W)
Desktop	Dell	0.78
	hp	0.69
	Acer	0.65

Figure 3: Desktops in standby mode

4.4 AIR CONDITIONER

Table 4: Air Conditioners in standby mode

	Brand	Standby Power (W)
Standby	Samsung	1.24
	Panasonic	0.57

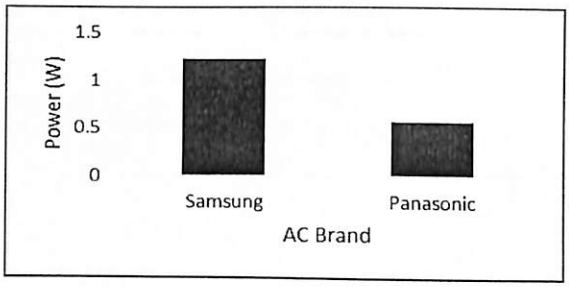


Figure 4: Air conditioners in standby mode

4.5 PHOTOCOPIER MACHINE

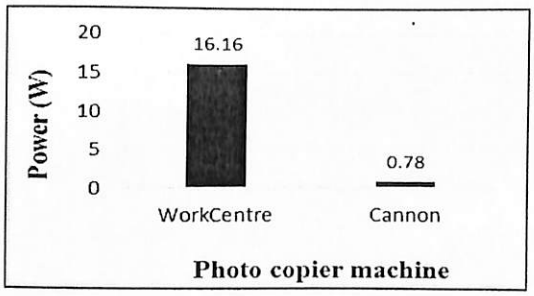


Table 5: Photo copier machine in standby mode

Standby	Brand	Standby power (W)
	WorkCentre	16.16
	Cannon	0.78

***Figure 5**: Photo copier machine in standby mode*

4.6 TELEVISION SET

Figure 6 : Television sets in standby mode

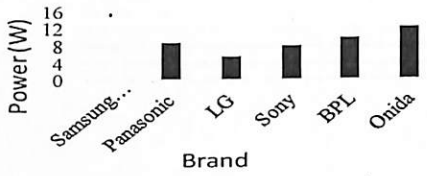


***Table 6:** Television sets in standby mode*

Sl. No.	Brand	Standby power (W)
1	Onida	12.36
2	Sony	8.09
3	BPL	10
4	Panasonic	9
5	LG	5.75
6	Samsung LCD	0

5. STANDBY ENERGY CONSUMPTION

The data obtained from the survey was used to get the time for the appliance used in standby mode in the residents around College of Science and Technology. The equipment of different brands were collected through the survey.

Table 6 : Percentage standby energy on the actual annual bill

Zones	Standby energy loss (kWhr/ yr)	Energy Bill on standby (Nu.)	Total Energy Bill (Nu.)	Perce-tage energy loss
Office	1766.9	3781.2	620181.8	0.61%
Resid-ential	312.1	667.8	228505.2	0.29%
Hostels	224.1	479.6	742472.1	0.07%

6. ENERGY BILL PAID FOR STANDBY ENERGY LOSSES

From data analysis, the energy loss in standby power consumption is computed for the monetary loss. The present tariff rate is used for the computation.

The graphical representation of the above table is as follows:

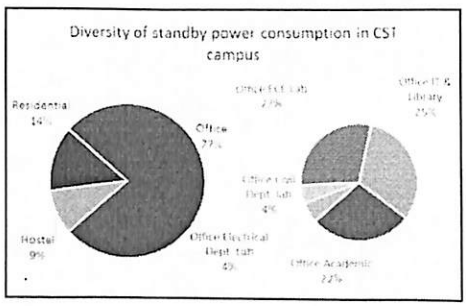


Figure 7: Energy losses in different zones

Under the Office Area, maximum charge is accounted by IT & Library. This is because computers, ACs, printers and photocopier machines in the IT building and library are always kept in standby mode. Users, especially students are unaware of such standby power consumption.

In the case of Hostel Area, Rinchhen Khangzang (RK) consisting of two blocks, one for girls and another for boys (accommodates 192 students), is the highest consumer of standby power while Block D (accommodates around 72 students) is the lowest consumer.

On account of the less numbers of people in residential areas compared to hostel and office areas, the standby power consumed is less.

7. RECOMMENDATIONS

i. For more conclusive studies, it is recommended to carry out the study in larger areas like cities, industrial areas, etc.

ii. Due to the presence of poor power factor and circulating currents and harmonics in standby mode, there is a need to study on these effects, particularly in quality of power.

iii. Standby power and energy losses needs to be quantified and made a certain quota in the commercial sector.

iv. To curb the increase in standby power and energy losses in households there is a need to introduce effective policies and standards.

v. Awareness campaign needs to be intensified and expanded to larger consumers through various media.

vi. Higher Energy Star graded and latest technology appliances consume less standby power. So, consumers need to give priority to higher energy star graded.

8. CONCLUSION

In this project report, the survey was carried out in three zones: Residential households, hostel blocks and offices. The measurement done on appliances have been presented and explained.

The following data had been established from the survey:

i. General habits and pattern of power consumption.

ii. Consumer awareness on appliances' standby power and energy losses.

iii. Estimation on the duration of appliance use.

The energy losses are analyzed and discussed. Research was carried out in three phases; survey, measurement of standby power consumption and mathematical calculation on energy losses due to standby power consumption.

Survey were carried out on appliances in 21 residential households, 184 hostel rooms and 22 offices, which have been presented and explained. From the survey, laptop was found to be the most commonly used appliance in the campus. It was also found to be the major standby power consumption in the campus.

A measuring device called Kill-A-Watt meter was used for the measurement of standby power consumption. Measurements were taken for appliances that consumed standby power prominently. With this data, suitable analysis has been drawn for the economic use of power.

Measurement results showed poor power factors at standby mode. Different brands

of laptops were measured. On an average, HCL brand consumes the maximum standby power of 4.10 W and Samsung with 0.55 W as the least.

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